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DEPARTMENTS.

SOLUTIONS OF PROBLEMS.

ALGEBRA.

344. **Proposed by V. M. SPUNAR, Cleveland, Ohio.**

Given $x^7-5x^2y^4=-1506...(1)$, and $y^5-3xy=103...(2)$; find the values of x and y.

Solution by E. B. ESCOTT, Ann Arbor, Mich.

Drawing the graphs of the two equations we see that the only real intersection is for x between -2 and -2.84, and y between 2.4 and 2.53.

A few trials give the values to a few decimals

$$x=-2.4168, \quad y=2.43359.$$

Also solved by the Proposer.

345. **Proposed by E. B. ESCOTT, Professor of Mathematics, University of Michigan.**

Solve the simultaneous equations:

$$x^3+y^2z+zw^2-xz^2-2wxy=a...(1).$$
$$y^3+z^2w+wx^2-yw^2-2xyz=b...(2).$$
$$z^3+w^2x+xy^2-zx^2-2yzw=c...(3).$$
$$w^3+x^2y+yz^2-wy^2-2zwx=d...(4).$$

Solution by the PROPOSER.

If we put the determinant

$$\begin{vmatrix} x & y & z & w \\ w & x & y & z \\ z & w & x & y \\ y & z & w & x \end{vmatrix} = D...(5),$$

we see that the minors of the first row are the first members of the given equations. Therefore, the minors of x, y, z, w in the determinant, D, are equal to a, b, c, d. Therefore the determinant

$$\begin{vmatrix} a & -b & c & -d \\ -d & a & -b & c \\ c & -d & a & -b \\ -b & c & -d & a \end{vmatrix} ...(6),$$

is the reciprocal determinant of D and is therefore equal to D^3. Also by the